**Problem Session 1: Chapters 1, 2, 3, 5, and 11**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Underline the significant digits in the following measurements:
	1. 12.202 km
	2. 0.01 mL
	3. 205 °C
	4. 0.010 g
2. Perform the following calculations and give the answer to the correct number of significant figures:
	1. (5.03 + 7.2)/0.003

$$\frac{(5.03+7.2)}{0.003}=\frac{12.23}{0.003}=4076.666667≈4000 or 4×10^{3}$$

* 1. (0.93 × 0.054)/1.32

$$\frac{(0.093×0.054)}{1.32}=\frac{0.005022}{1.32}=0.003804545≈0.0038 or 3.8×10^{-3}$$

* 1. (6.23 × 0.042) + 9.86

$$\left(6.23×0.042\right)+9.86=0.26166+9.86=10.12166≈10.12$$

1. State whether each is a property of metal or nonmetal:
	1. ductile metal
	2. conducts electricity metal
	3. brittle nonmetal
	4. reacts with metals and nonmetals nonmetal
2. Is each of the following is a physical or chemical property?
	1. iron oxidizes to rust chemical property
	2. titanium pulls into a fine wire physical property
	3. water has a density of 1.00 g/mL physical property
	4. sugar ferments to alcohol chemical property
3. Classify each of the following as an element, compound, mixture or solution.
	1. Sea water mixture
	2. Uranium element
	3. Ethanol, C2H5OH compound
	4. Nitrogen gas, N2 element
	5. Diamond element
	6. 3% hydrogen peroxide solution
4. Complete the following conversions:
	1. How many megaseconds are in 20.0 years?

years → days → hours → seconds → megaseconds

$$20.0 yrs×\frac{365 days}{1 yr}×\frac{24 hr}{1 day}×\frac{3600 s}{1 hr}×\frac{10^{-6}Ms}{1 s}=630.72 Ms=631 Ms$$

* 1. Calculate the number of mm in 1.75 miles.

miles → feet → inches → cm → mm$1.75 mi×\frac{5280 ft}{1 mi}×\frac{12 in}{1 ft}×\frac{2.54 cm}{1 in}×\frac{10^{3} mm}{10^{2} cm}=28163.52 mm=2.82×10^{6} mm$
$$1.75 mi×\frac{5280 ft}{1 yr}×\frac{12 in}{1 ft}×\frac{2.54 cm}{1 in}×\frac{10^{3} mm}{10^{2} cm}=2816352 mm=2.82×10^{6} mm$$

* 1. Convert room temperature, 25 °C, to °F.

°F = 9/5 °C + 32

°F = 9/5 (25) + 32 = 45 + 32 = 77 °F

* 1. Convert body temperature, 37 °C, to K.

K = °C + 273.15

K = 37 + 273.15 = 310.15 K = 310. K

* 1. Convert 2.00 in2 to mm2.

in2 → cm2 → mm2

$$2.00 in^{2}×\left(\frac{2.54 cm}{1 in}\right)^{2}×\left(\frac{10 mm}{1 cm}\right)^{2}=1290.32 mm^{2}≈1290 mm^{2} or 1.29 ×10^{3} mm^{2}$$

1. Bronze is 80.0% by mass copper and 20.0% by mass tin. A sculptor is preparing to cast a 1.75 lb bronze figure. How many kg of copper is needed?

 1 lb = 454.59 g

lb bronze → lb copper → g copper → kg copper

100 lb bronze = 80.0 lb copper 1 kg = 1000 g

100 lb bronze = 20.0 lb tin

$$1.75 lb bronze×\frac{80.0 lb copper}{100 lb bronze}×\frac{453.59 g}{1 lb}×\frac{1 kg}{1000 g}=0.635026 kg=0.635 kg copper$$

1. A 355 mL (12.0 fl oz) can of Diet Dr. Pepper contains 55 mg of sodium (2% of the daily recommended allowance). How many pounds of sodium are ingested if 7.7 × 102 gallons of Diet Dr. Pepper are consumed?

gallons → liters → mL → mg Na → g Na → lb Na

$7.7×10^{2}gal×\frac{3.785 L}{1 gal}×\frac{1000 mL}{1 L}×\frac{55 mg Na}{355 mL}×\frac{1 g}{1000 mg}×\frac{1 lb}{454.59 g}=0.99lb Na$

1. A graduated cylinder is initially filled with 15.0 mL of water. A piece of aluminum weighing 0.033 lbs is added to the water and the water level rises to 21.3 mL.
	1. What is the measured density of aluminum in g/mL?

Vi = 15.0 mL

M = 0.033 lb

Vf = 21.3 mL

$$d= \frac{m}{V}=\frac{0.033 lb}{(21.3 mL-15.0 mL)}=\frac{0.033 lb}{6.3 mL}×\frac{454.59 g}{1 lb}=2.4\frac{g}{mL}$$

* 1. If the actual density of aluminum is 2.7 g/cm3, what is the percent error?

$$\%error=\frac{observed value-accepted value}{accpted value}×100$$

$$\%error=\frac{2.4\frac{g}{mL}-2.7\frac{g}{mL}}{2.7\frac{g}{mL}}×100$$

$$\%error=\frac{-0.3\frac{g}{mL}}{2.7\frac{g}{mL}}×100$$

$$\%error=-11.1111111\%≈-10\%$$

1. If a bullet is shot at 500.0 ft/s, how fast is this bullet traveling in mi/hr?

$$\frac{ft}{s}\frac{}{\rightarrow } \frac{ft}{hr}\frac{\rightarrow }{}\frac{mi}{hr}$$

$$500.0\frac{ft}{s}×\frac{3600 s}{1 hr}×\frac{1 mi}{5280 ft}=340.9\frac{mi}{hr}$$

1. The recommended intravenous dose for “DOPRAM”, a respiratory stimulant, is 0.75 mg/kg body weight. DOPRAM is sold as a solution that contains 20.0 mg per mL of solution. How many mL of DOPRAM solution are required to provide an adequate dose to a 145 lb person?

lb body weight → g body weight → kg body weight → mg → mL solution

$$145 lb body weight×\frac{453.59 g}{1 lb}×\frac{1 kg}{1000 g}×\frac{1 g}{1000 mg}×\frac{0.75 mg}{1 kg body weight}×\frac{1 mL soln }{20.0 mg }=0.0025 mL soln $$

1. What are the forms of energy involved in the following examples?
	1. hydroelectric power plant electrical energy → heat energy
	2. sunlight falling on a solar water radiant energy → heat energy
	3. burning gasoline in a car engine chemical energy → mechanical and heat energy
2. Potassium has three main isotopes. Potassium-39 has a mass of 38.9637 amu and is the most abundant isotope at 93.2581%, potassium-40 has a mass of 39.9640 amu and a percent abundance of 0.0117%, potassium-41 has a mass of 40.9618 amu and a percent abundance of 6.7302%. What is the atomic mass of potassium?

$$atomic mass=\left(mass 1\right)\left(\frac{\%abundance 1}{100}\right)+\left(mass 2\right)\left(\frac{\%abundance 2}{100}\right)+…$$

$atomic mass=\left(38.9637 amu\right)\left(\frac{93.2581}{100}\right)+\left(39.9640 amu\right)\left(\frac{0.0117}{100}\right)+\left(40.9618 amu\right)(\frac{6.7302}{100})$

$$atomic mass=36.3368 amu+0.00468 amu+2.7568 amu$$

$$atomic mass=39.0983 amu$$

1. Complete the following table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Atomic | Atomic | Mass  | Number of | Number of | Number of  |
|  | Notation | Number | Number | Protons | Electrons | Neutrons |
|  | **7834Se2-** |  **34** | 78 | 34 | 36 |  **44** |
|  | Xe-131 |  **54** | 131 |  **54** | **54**  |  **77** |
|  | **120**50Sn4+ | 50 | **120**  |  **50** |  **46** | 70 |

1. Suppose you want to turn atoms of lead into atoms of gold. What would you have to do to the nucleus of the lead atoms?

Lead has 82 protons in its nucleus while gold has 79 protons in its nucleus. Therefore, to turn lead into gold you would have to remove 3 protons from the nucleus.

1. Write the shorthand electronic configuration for the following:
	1. Si: [Ne] 3s23p2
	2. Pb: [Xe] 6s24f145d106p2
	3. Cl: [Ne] 3s23p5
	4. Cr2+: [Ar] 3d4
	5. S2-: [Ne] 3s23p6 = [Ar]
	6. Pb4+: [Xe] 4f145d10
2. Rank the following atoms in order of increasing radius:

 2 N 3 Sb 4 Rb 5 Cs 1 F

1. Name the element that corresponds to each of the following:
2. alkali metal with the smallest atomic radius Li
3. Group 5A element with the highest ionization energy N
4. [Kr] 5s24d10 Cd